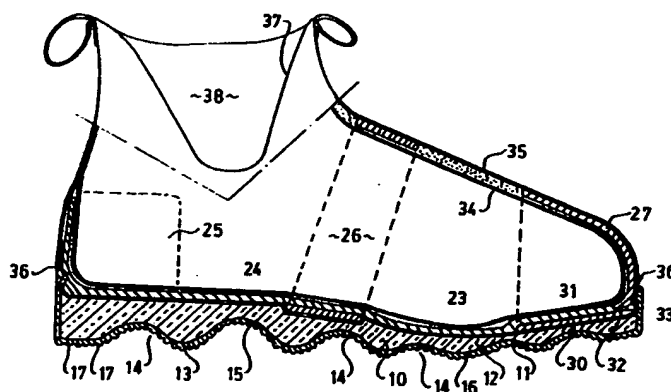




## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<p>(21) International Application Number: PCT/AU91/00122</p> <p>(22) International Filing Date: 2 April 1991 (02.04.91)</p> <p>(30) Priority data: 71280/91 21 February 1991 (21.02.91) AU</p> <p>(71) Applicant (for all designated States except US): TECHBOOT PTY. LTD. [AU/AU]; "Clover Park", Myocum via Mullumbimby, NSW 2482 (AU).</p> <p>(72) Inventors; and (75) Inventors/Applicants (for US only) : ALEXANDER, Michael, Robert [AU/AU]; "Clover Park", Myocum via Mullumbimby, NSW 2482 (AU). SWEENEY, William [AU/AU]; Lot 1, Dingo Lane, Myocum via Mullumbimby, NSW 2482 (AU).</p>	<p>(74) Agent: PIZZEY, John, K.; Pizzey &amp; Company Patent Attorneys, Level 6, Trustee House, 444 Queen Street, Brisbane, QLD 4001 (AU).</p> <p>(81) Designated States: AT, AT (European patent), AU, BB, BE (European patent), BF (OAPI patent), BG, BJ (OAPI patent), BR, CA, CF (OAPI patent), CG (OAPI patent), CH, CH (European patent), CM (OAPI patent), DE, DE (European patent), DK, DK (European patent), ES, ES (European patent), FI, FR (European patent), GA (OAPI patent), GB, GB (European patent), GR (European patent), HU, IT (European patent), JP, KP, KR, LK, LU, LU (European patent), MC, MG, ML (OAPI patent), MR (OAPI patent), MW, NL, NL (European patent), NO, PL, RO, SD, SE, SE (European patent), SN (OAPI patent), SU, TD (OAPI patent), TG (OAPI patent), US.</p> <p>Published With international search report.</p>	

(54) Title: PROTECTIVE FOOT CAPSULE



## (57) Abstract

The present invention is, in one embodiment, directed to protective boots including a flexible outer sole (10) including an abrasion-resistant outer surface (11) and an inner cellular sole core (12). The outer sole (10) is provided with transverse ridges (13) and transverse depressions (14), including a relatively large transverse depression (15) and a relatively broad transverse ridge at (16). The undersurface of the outer sole (10) is provided with a plurality of small ripples (17). The transverse ridges (13) are provided with longitudinal cut-outs (20) to provide drainage beneath the sole. About the periphery of the outer sole (10) is provided a flange portion (21) having formed therewith a locking bead (22). A protective insert (23) is provided having a moulded inner sole (24) and heel counter (25) members. Affixed to the inner sole (24) is an arch protector (26) and a toe cap (27). The toe cap (27) is retained to the inner sole (24) by means of the lower surface (30) of the toe cap (27) underlying the forward end (31) of the inner sole (24) and being locked thereto by the snapping-in of a tongue (32) of the forward end (31) into a recess (33) provided in the toe cap (27). Within the insert (23) is adhered a fabric-backed foam liner (34) to provide comfort to the wearer. Without the insert (23) is a boot outer (35) adapted to encapsulate the insert (23) and to provide the exterior surface of the boot upper. The toe cap (27), heel counter (25) and arch protector (26) are provided with recesses (36) adapted to receive the locking bead (22) of the flexible outer sole (10).

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**"PROTECTIVE FOOT CAPSULE"**

This invention relates to protective footwear.

This invention has particular but not exclusive application to workboots for use in firefighting and chemical spill applications, and for illustrative purposes reference will be made to such application. However, it is to be understood that this invention could be used in other applications, such as general purpose workboots and protective footwear.

10 In general, protective footwear for use in firefighting and chemical spill applications, and indeed for most industrial workboot applications, has been manufactured using traditional methods which were developed over time to accommodate the limitations of working with leather as the  
15 primary structural and protective material. The techniques used in manufacture have also generally been those that have developed retaining the basic construction principles of an age prior to the advent of sophisticated machinery and materials and have not generally deviated from such  
20 principles of construction even where the materials have not readily lent themselves to such methods.

In particular, boot production generally revolves around the generation of piecework components of the boot which are then formed up and assembled on a traditional last or  
25 bootmaker's anvil, to be then stitched together by skilled machinists. The traditional techniques accordingly suffer from the disadvantages of requiring a high level of machinist skill and time.

Where toe caps, heel guards and the like must be  
30 inserted in the workboot, these are generally incorporated as insert pieces interposed between layers of the traditional boot construction. Accordingly, such protective footwear is generally heavy out of all proportion to the degree of protection afforded by the insert.

35 The present invention aims to alleviate the above disadvantages and to provide apparatus which will be

reliable and efficient in use. Other objects and advantages of this invention will hereinafter become apparent.

With the foregoing and other objects in view, this invention in one aspect resides broadly in a protective boot

5 assembly including:-

a boot upper portion;

a boot sole portion affixed to said upper portion, and

a protective insert member including a flexible inner sole portion and a heel counter portion.

10 The boot sole portion and boot upper portion may each take any form consistent with the function of providing a suitable exterior of a protective work boot. In general, the precise form of the assembly of upper and sole will at least in part be dictated by the type of protection to be afforded.

15 For example, for use in chemical spill work the upper and sole may be generally or specifically constructed of materials proof against the expected contaminants.

The protective insert member may take any form consistent with the function of providing some protection to  
20 the sole and heel of a wearer of the boot. Preferably, the protective insert member comprises a moulded polymeric sole portion having integrally formed therewith a heel counter portion, although it is also envisaged that the heel counter portion may be affixed to the sole portion by any suitable  
25 means such as interlocking complementary joining means. Preferably, the heel counter portion is of relatively rigid form compared with the sole portion such that the sole portion retains some flexibility whilst providing penetration resistance, thus promoting a natural and comfortable walking  
30 gait, whilst the heel counter provides maximum protection against impact and crushing.

Preferably, the protective insert member further includes one or both of a toe cap and an arch protector. The toe cap and arch protector may be relatively stiff compared  
35 to the sole portion in order to maximise impact resistance with a minimum of unnecessary bulk. The toe cap and/or arch

protector may take any form consistent with the function of providing protection to the to region and/or th arch region of a wearer's foot. Preferably, the toe cap and/or arch protector are moulded integrally with the sole and heel counter to provide an integral, full function protective insert member, providing for foot flexibility as well as penetration resistance and protection against side or rear impacts. Alternatively, the toe cap and arch protector may be affixed to the sole and heel counter moulding or assembly by any suitable means.

Preferably, the shapes of the arch protector and toe cap are selected so objects tend to roll off, the shapes of one or more of said arch protector portion and toe cap portion being preferably moulded such that their outer surfaces run away from their respective top centres. It has been found that this arrangement of the toe cap and arch protector substantially overcomes the disadvantages in this regard of standard boots, which generally only have toe caps. The toe caps used by the prior art are generally flat and often angled backwards due to the spring of the shoe, providing no protection for the arch.

Preferably, the sole portion of the protective insert provides protection from penetration through the sole and heel and preferably provides, in conjunction with the toe cap and arch protector if desired, a protective capsule for the foot as a whole from objects impacting on the sides and top. For example, if the foot is caught under debris or if a person falls and is then hit, boots in accordance with the present invention may protect the foot against injury. Preferably, the area of the sole portion between the arch protector and the heel counter is arched to provide desirable support for the foot over the full width of the arch to assist with long term wearer comfort and support.

Preferably, the heel counter portion is angled inward towards the top, as does the heel of the foot, to provide better support and stability. The sole portion of the

protective insert is preferably provided with a concave depression in the heel area to accept the heel in its natural shape.

Preferably, the relative shapes and hence the distance  
5 between the toe cap and arch protector are selected to allow the maximum amount of foot flexing at the ball of the foot whilst maintaining the minimum distance at the top between the two consistent with allowing for the maximum extension of the foot.

10 Where the heel counter portion is an integral part of protective insert it is preferred that the relative stiffnesses of the heel counter portion and sole portion are selected such that sideways forces are not transferred to the counter, a common defect of the prior art which leads to less  
15 foot support and tends to cause the counter to degenerate. In addition, where an arch protector and toe cap are included, it is preferred that the insert member be fully integral to form a protective foot capsule since this reduces the number of components in the manufacturing process.

20 In kind with the preferred integral heel counter, it is preferred that the toe cap portion and arch protector portion of the protective insert be relatively rigid compared with the sole portion to provide resistance to crushing and impact whilst permitting flexing of the foot. The relatively stiff  
25 outer edges of the toe cap portion and arch protector portion may meet the more flexible sole portion, restricting the sole portion from flexing during impact in the region of the toe cap portion and arch protector portion, whilst maintaining the aforementioned flexibility between the relatively rigid  
30 portions. Preferably, the arch protector shape is selected to provide maximum width of the arch protector portion for as much of the height of the arch protector portion as possible to facilitate the free movement in and out of the boot, the widest part of the foot being generally forward of the  
35 protector with the angle of entry of the foot being generally higher during entry and exit than during wearing the boot.

The shape and configuration of the toe cap portion is preferably selected to yield a toe cap having the shape of a portion of an egg and is both relatively high off the foot at the rear of the toe cap and has no flat surfaces. The height of the preferred toe cap not only allows for objects to roll off the foot but enables the foot to bend fully without the upper rubbing against the top of the foot. The "egg" shape of the preferred toe cap greatly increases its ability to resist impacts and provides a more protective capsule for the toes than toe caps of the prior art.

Preferably, the inside of the boot in the region of the counter portion is padded with a suitable padding material such as a non-flammable cellular elastomer. Preferably, the elastomer is selected from those having a shore hardness of about 25 to provide an acceptable compromise between comfort and strength. Such padding fulfills not only the function of providing comfort and supportive feel for the heel, but also allows for heel abnormalities to be comfortably accommodated.

The foot contact area within the protective insert member may also be lined with a comfort promoting material. Preferably, the boot includes an internal lining sock of fine leather or other suitable material, and the space between the internal lining sock and the protective insert member is preferably padded with a non flammable polymeric foam such as an ester foam. Preferably, the foam is selected to have a density suitable for providing a firm, comfortable feel without putting any pressure on any foot abnormalities, such as bunions, spurs and the like.

Boots manufactured in accordance with the present invention may be provided with a footbed, with it being preferred to use a footbed of a similar type to that used in the mid soling of better quality sporting footwear. Preferably, the footbed is of a substantially non flammable closed cell foam polymeric material, providing a comfortable and supportive base for the foot. The depth of the sock liner together with its shape may be selected for supportive

quality and to provide for orthotic adjustments where necessary.

The protective footwear in accordance with the present invention may be closed by any suitable means. Preferably, 5 the protective footwear is closed by means of self adjusting, non flammable elastomer such as that having similar qualities to the elastic in elastic sided boots. The protective footwear may also be provided with a quick close/release attachment, preferably of the type useful to surround the 10 ankle and the top of the protective footwear. The elastomeric adjustment allows for comfort of fit, the elasticity thereof also providing support whilst not overly reducing movement of the foot.

Preferably, protective footwear in accordance with the 15 present invention are provided with ankle restraining means to provide ankle support whilst not totally eliminating for and aft movement of the foot, a movement which is important, particularly when driving. Desirably, the ankle support means also serves to help prevent the foot slamming against 20 the toe cap, for example, when going down hill. Preferably, the ankle support means takes the form of a flexible strap member angled from the base of the achilles tendon, across the ankle and over the instep. Preferably, similar support is provided for the lower leg by means of a supporting 25 closure at the top of the boot which may also serve the purpose of providing closure against the trouser leg of the wearer.

The outer sole portion of the protective footwear, as stated, may take any suitable form, generally dictated by the 30 use to which the footwear is put. However, it has now been determined that a particular type of outer sole is amenable for use in a wide variety of applications, such as fireman's boots for use in both chemical spill and firefighting applications. In the past, it has generally been necessary 35 for firemen to maintain a plurality of specialized footwear for use in such diverse applications. Whilst a fire boot may



not have the chemical resistance of a specialised chemical-spill boot, this has generally occurred because the soling of the chemical boot was unsuitable for use in a fireboot and accordingly it was not worth making the fire boot chemical  
5 resistant.

Accordingly, in a further aspect, this invention resides broadly in a boot sole including:-

a flexible body having a lower ground engaging surface,  
and  
10 a plurality of substantially transverse ridges provided on said ground engaging surface and defining a plurality of transverse depressions therebetween, wherein said ridges and depressions in combination provide a waveform profile to said ground engaging surface.

15 The flexible body of the boot sole may take any suitable form and is preferably of a fire and chemical resistant natural or synthetic resilient material. Preferably, the body member is an integral moulding of two parts, namely, a tough outer skin of heavy duty rubber providing abrasion and  
20 penetration resistance and an enclosed cellular layer allowing for considerable weight saving and improved shock absorption.

Preferably, the body is of a wedge shape, rather than the conventional sole and heel moulding to provide more even  
25 support. It has been found that the use of the wedge shape provides for lift at the toes is similar to sporting footwear as opposed to the rather gumboot-like action of conventional protective footwear.

The body may be provided with an upper peripheral  
30 extension to facilitate bonding or other attachment to a boot upper as well as providing additional protection from aggressive chemicals and abrasion. Preferably, the upper peripheral extension is angled inward from the periphery of the sole and is provided with an internal ridge, allowing the  
35 sole to engage a protective insert such as that hereinbefore described.

Preferably, the transverse depressions include a relatively large depression in the region of the instep of the sole, to provide enhanced ability to safely engage ladder rungs and the like. The depressions towards the toe and heel of the sole from the instep depression may be identical or may vary, with it being preferred that the sole be provided with progressively smaller depressions towards the toe and heel, providing for a gradation of sole flexibility away from the instep. Preferably, there is provided a relatively large ridge between depressions in the region of the ball of the foot of the wearer, the ridge and adjacent depressions forming a concave portion on either side of the ball of the foot, provide for enhanced foot flexibility with the minimum of movement of the outer sole, and a preferably longer convex portion under the ball of the foot to provide additional support.

The ground engaging surface may be smooth or may be provided with a textured surface to improve the grip of the sole. Preferably, the ground engaging surface is provided with a textured surface comprising generally transverse ripples or creping, the textured surface providing grip in both traction and braking. Preferably, the wave shape of the sole and the small ripples are selected such that walking shock is dissipated along the sole rather than directly upwards to the foot.

The wave shape of the preferred soles also allows stones, caked mud and the like to be released from the sole due to the normal walking action causing the sole to flex, periodically opening out the depressions.

Preferably, the ridges are also provided with a plurality of substantially longitudinal depressions cutting through the crests of the ridges between the transverse depressions, the wave shape, together with the longitudinal channels, allowing fluids to pass under the sole without around the sole and reduce the hydroplane effect.

Protective footwear in accordance with the present

invention is also amenable to significantly revised manufacturing techniques which are not available for application to many prior art protective boots.

Accordingly, in a further aspect, this invention resides  
5 broadly in a method of manufacturing a protective boot including:- providing a full foot boot lining sock;

providing a boot padding assembly;

providing a unitary protective boot insert;

providing a boot upper assembly;

10 providing an outer sole assembly;

placing said lining sock on a last;

installing said boot padding assembly, protective boot insert, and boot upper assembly on said lining sock, and

affixing said outer sole assembly to said boot upper  
15 assembly and said unitary protective boot insert.

Preferably, the manufacturing process of the present invention utilizes an air inflated last for ease of removal of the completed boot. Adhesive may be applied between each layer where desirable, and the upper region of the boot upper  
20 assembly and lining sock may be closed by any suitable upper closure means. The upper closure means may also secure the padding assembly to the boot outer and/or lining sock if desired.

In order that this invention may be more easily  
25 understood and put into practical effect, reference will now be made to the accompanying drawings which illustrate a preferred embodiment of the invention, wherein:-

FIG. 1 is a partial cross-section through an elastic sided workboot in accordance with the present invention;

30 FIG. 2 is a partial cross-section through a fire-fighting boot in accordance with the present invention;

FIG. 3 is a partial cross-section through a protective boot in accordance with the present invention;

FIG. 4 is a partial cross-section through a combat boot  
35 in accordance with the present invention; and

FIG. 5 is an inverted perspective view of a sole in

accordance with the present invention.

In figures 1, 2 and 4 there are illustrated protective boots including a flexible outer sole 10 comprising a tough abrasion-resistant outer surface 11 of the material known as hypalon. Formed integrally with the outer surface 11 is an inner cellular sole core 12, of cellular material such as cellular-hypalon.

The flexible outer sole 10 is provided with transverse ridges 13 and transverse depressions 14, including a relatively large transverse depression 15 and a relatively broad transverse ridge under the ball of the foot at 16. The undersurface of the flexible outer sole 10 is provided with a plurality of small ripples 17 from heel to toe thereof.

As is best illustrated in Figure 5 the transverse ridges 13 are provided with longitudinally directed cut-outs 20 adapted to provide for and aft drainage beneath the sole.

About the periphery of the flexible outer sole 10 is provided an integral upstanding flange portion 21 having integrally formed therewith an internally directed locking bead 22.

A protective insert 23 is provided having an integrally moulded nylon inner sole 24 and heel counter 25 member. Affixed to the inner sole 24 is a polycarbonate arch protector 26 and a polycarbonate toe cap 27. The toe cap 27 is retained to the inner sole 24 by means of the lower surface 30 of the toe cap 27 underlying the forward end 31 of the inner sole 24 and being locked thereto by the snapping-in of a tongue 32 of the forward end 31 into a recess 33 provided in the toe cap 27.

Within the protective insert 23 is adhered a fabric-backed foam liner 34 to provide comfort to the wearer. Without the protective insert 23 is a leather boot outer 35 adapted to encapsulate the protective insert 23 and to provide the exterior surface of the boot upper. The toe cap 27, heel counter 25 and arch protector 26 are provided

with recesses 36 adapted to receive the locking bead 22 of the flexible outer sole 10.

The leather outer skin 35 is cut away at 37 and the cut-away space filled in with an elasticised panel 38 adapted to comfortably grip the ankle of the wearer.

In the embodiment of figure 2 the leather outer skin 35 is replaced by a viton coated ballistic grade aramid fibre outer skin 40 to provide fire resistance to the boot. In this case, also, the fabric-backed foam liner 34 has been replaced by a soft leather lining sock 41. The fire-fighting boot of figure 2 also includes a cellular hypalon orthodically adjustable foot-bed 42 and a non-flammable ester foam lining 43.

Closure of the boot includes a gatherable insert panel 44 and rubber closing straps 45 adapted to draw the shin of the boot closer against the trouser leg of the user.

In the embodiment of figure 4, the outer skin 46 is of gortex-backed aramid fibre. The combat boot is further provided with a leather or like recovered perforated foam sock liner 47, a cellular hypalon heel cushioning 50 and a plurality of pump outlets 51 equipped with one-way valves not shown. The outlets 51 pass from a foam inner sole 52 to the outside of the boot, where necessary, piercing the protective insert 23 such as at 53.

In the embodiment of figure 3, the outer sole and boot upper are provided as an integral PVC moulding 55.

In use, protective insert members in accordance with the present invention allow the maximum area for toe comfort, particularly the great toe, and stability for the foot during the push off phase.

With the exception of the tooling costs for manufacturing the protective frame and the sole; equipment required can be low technology and therefore low cost and production can therefore be increased or decreased, without great capital outlay or having expensive equipment lying idle, by increasing or decreasing staff levels.

Although accuracy in stitching may be important, neatness is not, as, with the exception of the rear seam of the boot, seams are not seen.

Expensive set up costs items, such as tooling and production of the protective frame and sole can be carried out in one site, state or country and shipped to the market area with the uppers and assembly being completed there using local materials and labour.

Footwear in accordance with the abovedescribed preferred embodiment of the present invention provide desirable shock absorption through the use of cellular elastomers. The sole design, the soft, non-restrictive lining, surrounded by foams, the heel padding, and a firm, comfortable, orthopaedically adjustable footbed provide a light protective boot and make the boot comfortable to wear. Protection is provided for the foot as a whole by the use of an integral protective insert for the foot, rather than just a toe cap and puncture resistant device.

Boots manufactured in accordance with the present invention allow for a variety of materials to be used for any or all of the units to cover varying safety standards such as Fire Brigade impact standards for firefighting boots and varying uses, such as combat boots and firefighting boots. The end result is that material choice, and consequently the price, can relate directly to the requirements of the end user. In addition it allows for a number of types of footwear to use the same basic components.

The protective insert members of the abovedescribed preferred embodiment retain the advantages of:-

minimal conduction of heat and electricity;  
elastic recovery from the elastic limit of the material or disintegration if deformed beyond the elastic limit, that is, they do not take a new shape, resulting in the pressure being removed from the foot as soon as the object is removed as opposed to a steel toe cap which does change shape and may need to be cut away from the foot;

rust and deterioration resistance;

may be moulded to complex shapes allowing simpler "snap" type assemblies, and

cheap to produce after initial tooling costs.

5       It will of course be realised that while the above has been given by way of illustrative example of this invention, all such and other modifications and variations thereto as would be apparent to persons skilled in the art are deemed to fall within the broad scope and ambit of this invention as  
10 defined in the Claims appended hereto.

CLAIMS

1. A protective boot assembly including:-  
a boot upper portion;  
a boot sole portion affixed to said upper portion, and  
5 a protective insert member including a flexible inner sole portion and a heel counter portion.
2. A boot in according to Claim 1, wherein said protective insert includes a toe cap portion integral with or assembled to said flexible inner sole portion.
- 10 3. A boot according to any one of Claims 1 or 2, wherein said protective insert includes an arch protector portion integral with said flexible inner sole portion.
4. A boot according to Claim 3, wherein one or more of said heel counter portion, said toe cap portion and said arch  
15 protector portion are relatively rigid compared with said sole portion.
5. A boot according to Claim 4, wherein the shapes of one or more of said arch protector portion and toe cap portion are moulded such that their outer surfaces run away from  
20 their respective top centres.
6. A boot according to any one of the preceding Claims, wherein the inside of the boot in the region of said heel counter portion is padded with a non-flammable cellular elastomer having a shore hardness of about 25.
- 25 7. A boot according to Claim 6, and including an internal lining sock, the space between said internal lining sock and said protective insert member being padded with a non flammable polymeric foam.
8. A boot according to any one of the preceding Claims, and



including a footbed of a depth and/or shape selectable for supportive quality and/or orthotic adjustment.

9. A boot according to any one of the preceding Claims, wherein said boot sole portion includes:-

5 a flexible body having a lower ground engaging surface, and

a plurality of substantially transverse ridges provided on said ground engaging surface and defining a plurality of transverse depressions therebetween, wherein said ridges and  
10 depressions in combination provide a waveform profile to said ground engaging surface.

10. A boot sole including:-

a flexible body having a lower ground engaging surface, and

15 a plurality of substantially transverse ridges provided on said ground engaging surface and defining a plurality of transverse depressions therebetween, wherein said ridges and depressions in combination provide a waveform profile to said ground engaging surface.

20 11. A boot sole according to Claim 10, wherein said flexible body is of a wedge shape.

12. A boot sole according to Claim 11, wherein said flexible body comprises an integral moulding of a tough outer skin of rubber and a cellular inner portion.

25 13. A boot sole according to any one of Claims 10 to 12 wherein said transverse depressions include a relatively large instep depression in the region of the instep of the sole.

14. A boot sole according to Claim 13, wherein said  
30 depressions towards the toe and heel of the sole from said instep depression are progressively shallower away from said

instep depression.

15. A boot sole according to Claim 14, wherein there is provided a relatively large ridge between said depressions in the region of the ball of the foot of the wearer, said  
5 relatively large ridge and adjacent depressions forming a concave portion on either side of the ball of the foot, and a relatively longer convex portion under the ball of the foot.

16. A boot sole according to Claim 15, wherein said ground  
10 engaging surface is provided with a textured surface comprising generally transverse ripples or creping, the wave shape of the sole and said textured surface in combination being selected such that walking shock is dissipated along the boot sole.

17. A boot sole according to Claim 16, wherein said  
15 transverse ridges are provided with a plurality of substantially longitudinal depressions cutting through the crests of said ridges.

18. A method of manufacturing a protective boot including:-

20 providing a full foot boot lining sock;  
providing a boot padding assembly;  
providing a unitary protective boot insert;  
providing a boot upper assembly;  
providing an outer sole assembly;  
placing said lining sock on a last;  
25 installing said boot padding assembly, protective boot insert, and boot upper assembly on said lining sock, and  
affixing said outer sole assembly to said boot upper assembly and said unitary protective boot insert.

19. A method of manufacturing a protective boot according to  
30 Claim 18, wherein said last is an air inflated last.

20. A protective boot substantially as hereinbefor defined with reference to the accompanying drawings.

21. A boot sole substantially as hereinbefore defined with reference to the accompanying drawings.

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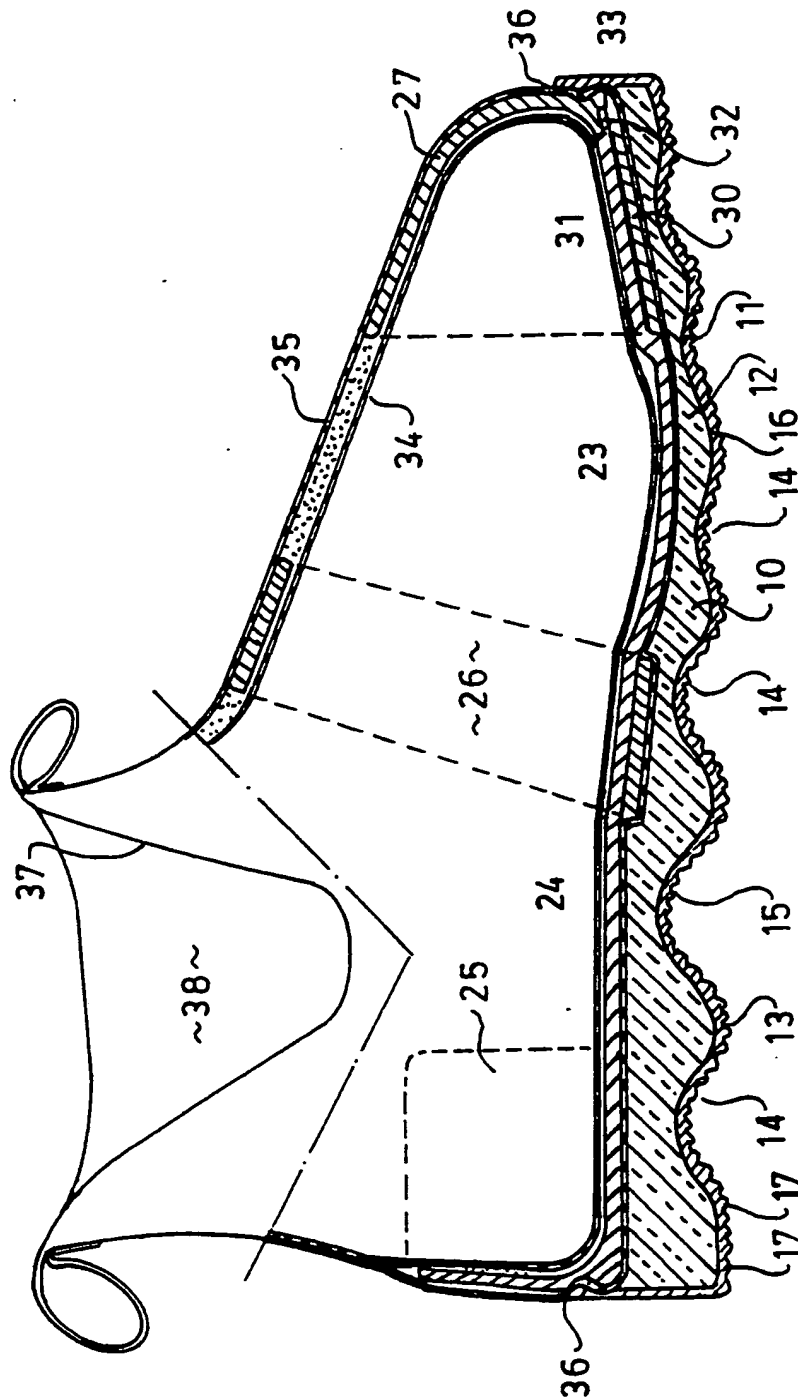


FIG. 1

SUBSTITUTE SHEET



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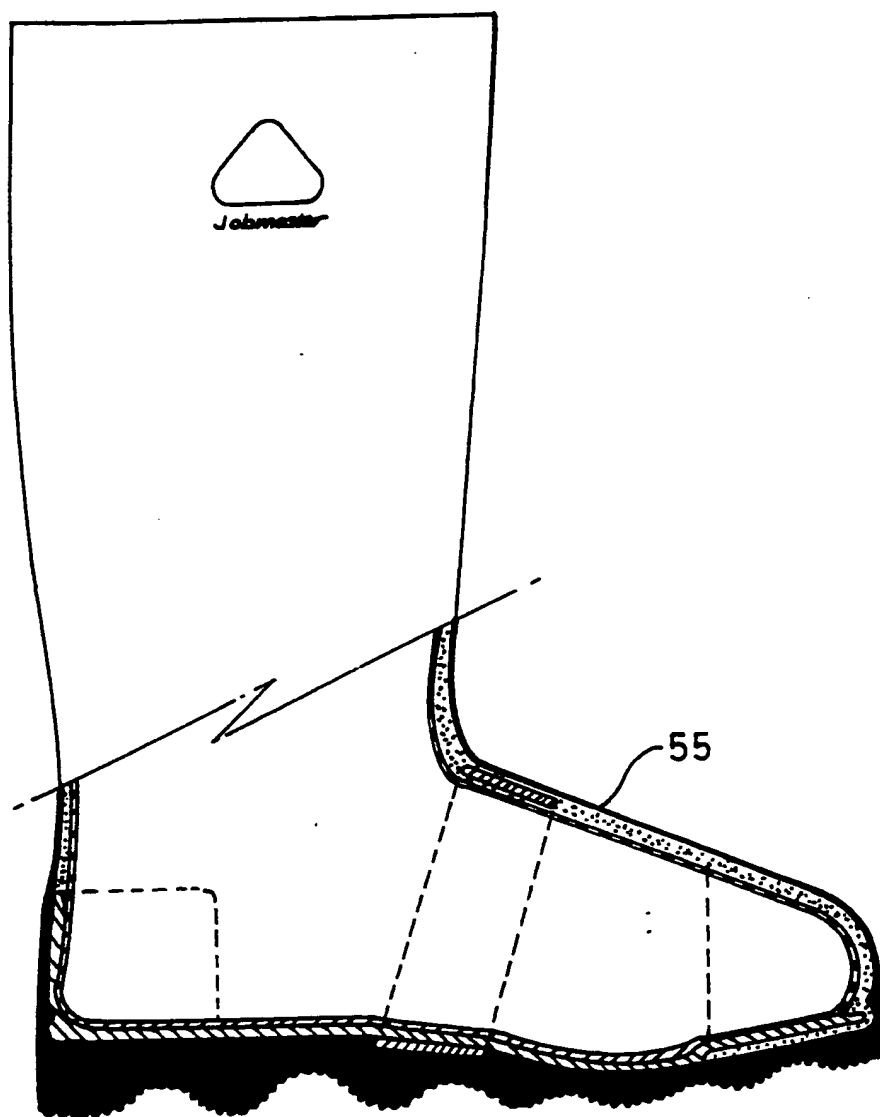
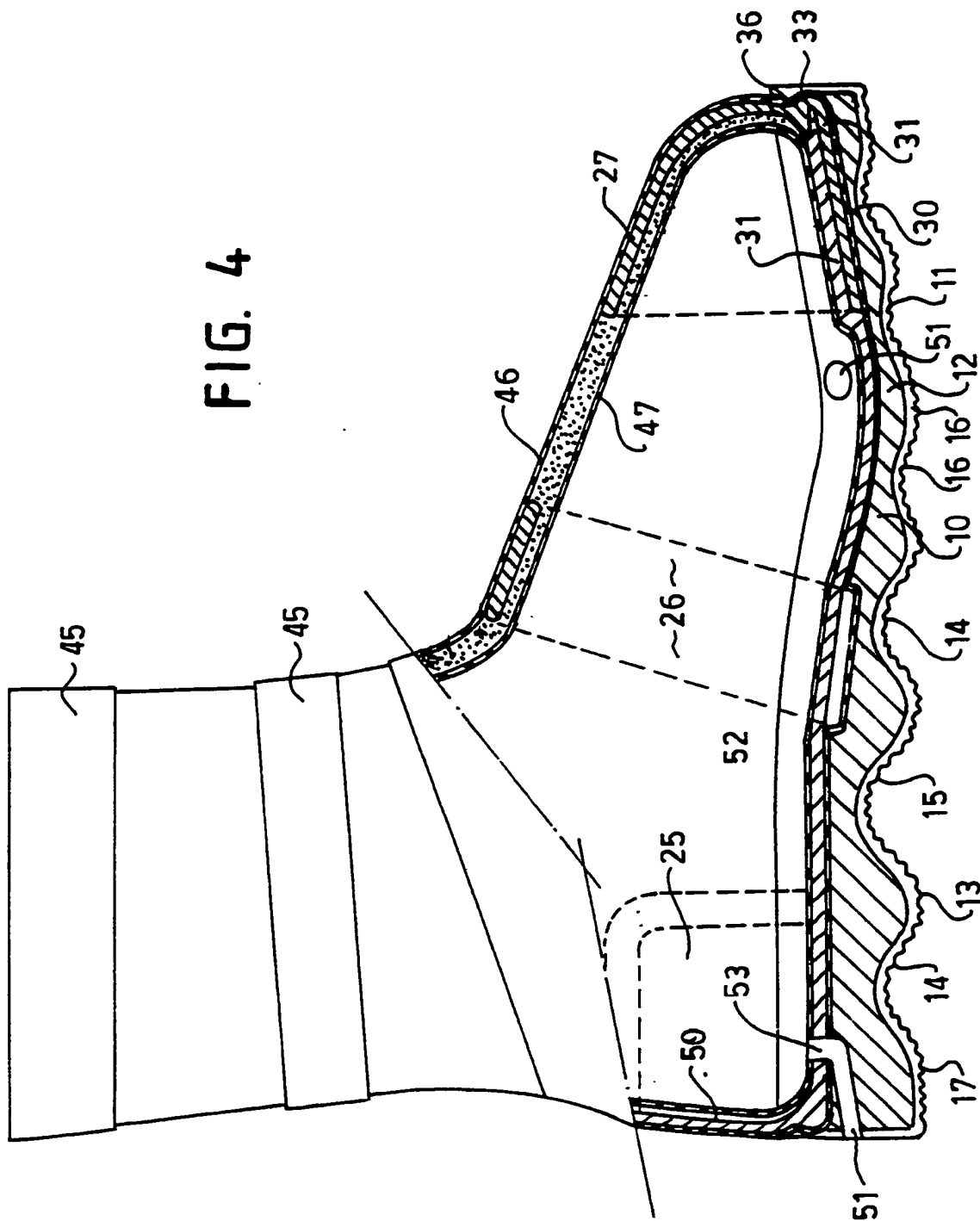


FIG. 3

SUBSTITUTE SHEET

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FIG. 4



SUBSTITUTE SHEET

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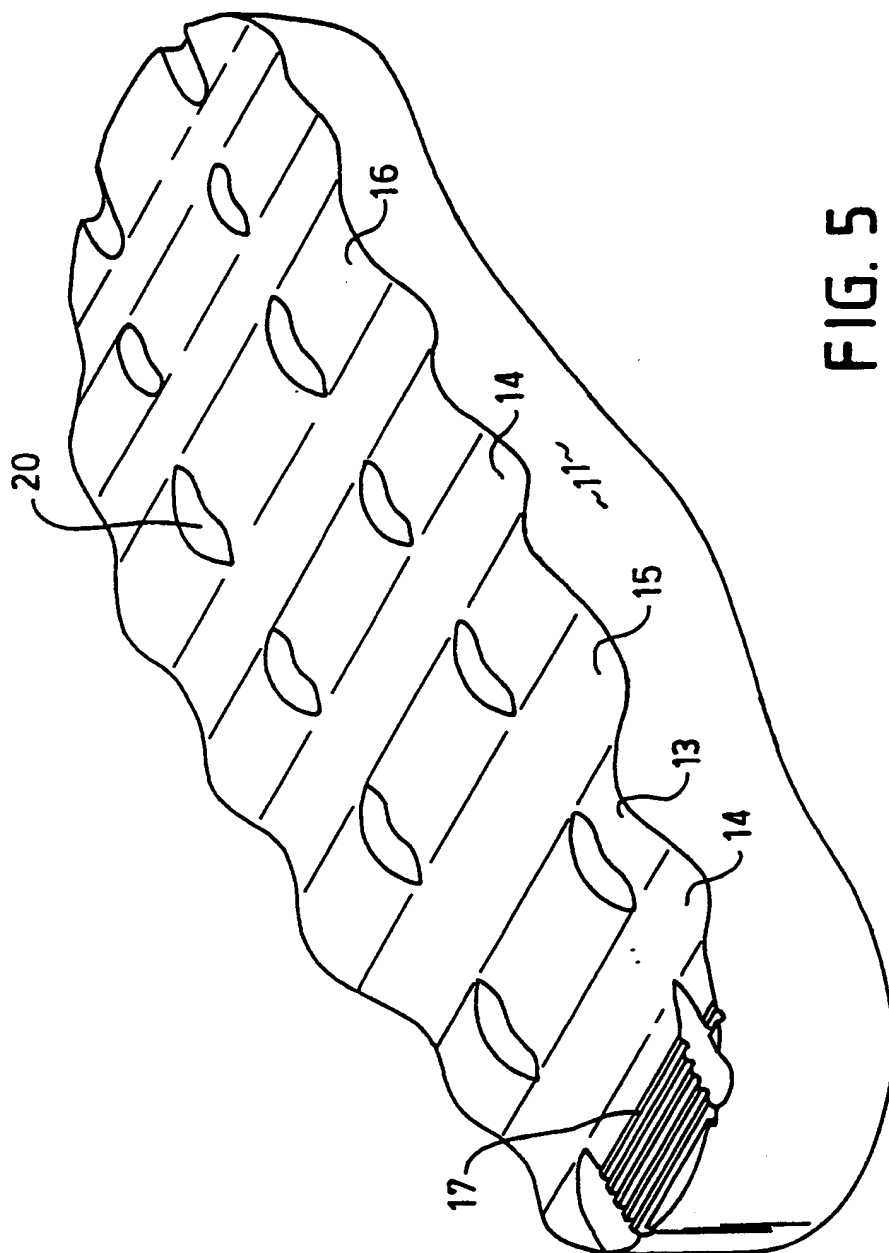


FIG. 5



## I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) 6

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl.<sup>5</sup> A43B 7/32, A43B 13/14

## II. FIELDS SEARCHED

Minimum Documentation Searched 7

Classification System |

Classification Symbols

IPC

A43B 7/32, A43B 13/14

Documentation Searched other than Minimum Documentation  
to the Extent that such Documents are Included in the Fields Searched 8

AU : IPC as above

## III. DOCUMENTS CONSIDERED TO BE RELEVANT 9

Category*	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages 12	Relevant to Claim No 13
X	US,A, 3248810 (BAUDOU) 3 May 1966 (03.05.66) all description & figures.	(1)
X	GB,A, 863944 (BTR INDUSTRIES) 29 March 1961 (29.03.61) figure 1	(1 & 10)
X	GB,A, 1436501 (FREUDENBERG) 19 May 1976 (19.05.76) all description & figures.	(1)
X	CA,A, 1249930 (DESCHAMPS) 14 February 1989 (14.02.89) figures.	(1)
X	EP,A, 0030839 (SCHERZ) 24 June 1981 (24.06.91) all description & figures.	(1 & 10)
X	DE,A, 611531 (UNGARISCHE GUMMIWAARENFABRIKS) 28 March 1935 (28.03.35) figures (contd)	(1)

\* Special categories of cited documents: 10

"A" document defining the general state of the art which is not considered to be of particular relevance

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"Z" document member of the same patent family

## IV. CERTIFICATION

Date of the Actual Completion of the  
International Search  
21 June 1991 (21.06.91)Date of Mailing of this International  
Search Report

2 July 1991

International Searching Authority

Signature of Authorized Officer

Australian Patent Office

B.R. DASHWOOD

## FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

X	DE,A, 2136522 (FUNCK) 1 February 1973 (01.02.73) figures.	(1)
X	US,A, 4498251 (SHIN) 12 February 1985 (12.02.85) figures.	(10)
X	US,A, 4302892 (ADAMIK) 1 December 1981 (01.12.81)	(10)
X	GB,A, 1198598 (SEMPERIT) 15 July 1970 (15.07.70) figures.	(10)
X	CA,A, 1174848 (ANNOVI) 25 September 1984 (25.09.84)	(10)

## V. [ ] OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE 1

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1.[ ] Claim numbers ..., because they relate to subject matter not required to be searched by this Authority, namely:

2.[ ] Claim numbers , because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3.[ ] Claim numbers ..., because they are dependent claims and are not drafted in accordance with the second and third sentences of PCT Rule 6.4 (a):

## VI. [ ] OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING 2

This International Searching Authority found multiple inventions in this international application as follows:

1.[ ] As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.

2.[ ] As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3.[ ] No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:

4. [ ] As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

## Remark on Protest

[ ] The additional search fees were accompanied by applicant's protest.

[ ] No protest accompanied the payment of additional search fees.

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON  
INTERNATIONAL APPLICATION NO. PCT/AU 91/00122

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Members			
GB	1436501	DE	7336712	NL	7411158
DE	2136522	GB	1316374	NL	7111081
				FR	2104310

END OF ANNEX